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ADDITIONAL NOTE ON *HELICINA OCCULTA*

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Since the publication of the paper on *Helicina occulta*¹ the writer visited the type locality at New Harmony, Ind., from which Say obtained his fossil specimens of this species. Not only did the more or less plant-covered bluff from which Say probably obtained his specimens yield a number of shells, but more numerous specimens were obtained from several large exposures along the roads leading south from New Harmony which have been excavated since Say's time. The species is not as common, however, as in many of the more westerly localities.

Two loesses also occur here, the lower being the characteristic post-Kansan loess, and the upper, a light yellow loess, probably post-Illinoian. Few shells of *Helicina occulta* were found in the upper loess, and they average about 6.5 mm in diameter.

The species is more common in the post-Kansan loess, and the shells from this loess are of special interest because of their large size. In the paper cited (pp. 177-79) the diameter of the largest fossil shells known from the loess is given as 7.25 mm, while that of the largest known recent specimens from the loess-covered region is 7.50 mm.² Several of the shells from the post-Kansan loess of New Harmony measure 7.50 mm, and the average is more than 7 mm. Thus the range of variation in the size of the recent shells within the loess-covered territory is fully equaled by that of the fossils, and differences in size cannot, therefore, be accounted for by general climatic conditions. The distribution of the smallest forms of this

¹ *Proceedings of the Davenport Academy of Science*, Vol. IX, pp. 173-80.

² The largest authentically reported recent specimens were collected by Walker and Pilsbry on Mount Mitchell, North Carolina, and are reported in the *Proceedings of the Academy of Natural Sciences*, Philadelphia, in May, 1902, on p. 421, as follows: "A few large specimens, diameter $7\frac{1}{4}$ to 8 mm, were found under the dead leaves around the roots of the basswoods and buckeyes." This locality, however, is far outside the loess-covered region.

species, as well as the example of other terrestrial shells such as *Succinea obliqua*, *Polygyra multilineata*, etc., would suggest rather that local variations in the minimum amount of moisture are responsible for the differences in size, the smallest shells occurring in the driest or most exposed places. The average diameter of both recent and fossil forms becomes a little less as we go westward into drier regions, and "depauperation," so far as it exists not only in this, but in other species which occur in the loess, points decidedly toward a dry rather than a cold climate.

Perhaps further emphasis should be placed upon the distribution of both the recent and fossil forms of this species. Reference to the first paper on *Helicina occulta*¹ shows that the northernmost points at which recent specimens of that species were collected are Winona and Stockton, Minn., and De Pere, Wis.; the westernmost point is Eldora, Iowa; the most southerly point is South Pittsburg, near the southern line of Tennessee; while eastward the species extends beyond the mountain to Virginia. The southern limits of distribution lie beyond the border-line of the southernmost drift-sheet, the Kansan, and the eastern limits extend beyond the southeastern border-line of the Wisconsin drift. Northward the species extends locally over the Iowan, and a portion of the Wisconsin drift areas (in Minnesota (?) and Wisconsin), and also over a part of the driftless area in Iowa.

The fossils are more restricted in both their northerly and southerly distribution, but extend farther west, being known from the southwestern part of Howard County, Nebraska.² The known northern limit extends from Cuming County, Neb., to Woodbury and Johnson Counties, Iowa, Moline, Ill., and Sullivan County, Ind.³ The southern limit, so far as is now known definitely, is at Kansas City, Booneville, and St. Louis, Mo.; Gallatin County, Ill.;⁴ and Posey County, Ind. Owen also mentions *Helicina*, without specific name,

¹ *Loc. cit.*, pp. 174, 175.

² See *American Geologist*, Vol. VII (1891), p. 40.

³ Reported from the last locality by Collett, *Second Report of the Geological Survey of Indiana* (1871), p. 227.

⁴ Reported by Cox, *Geological Survey of Illinois*, Vol. VI (1875), p. 210; *Economic Geology of Illinois*, Vol. III (1882), p. 561.

as occurring in Hickman County, Ky.¹ This is probably *H. orbiculata*, as Dana reports this species from Hickman, Ky., on the authority of Wetherby,² though Hickman County is so near the southern limit of fossil *H. occulta* that it may have been the latter species. However, neither conclusion would affect the discussion herein presented.

Since these two species have been frequently confused, the error leading to erroneous references to distribution which would mislead those who are not familiar with the facts in the case, some additional notes on this point are here offered.

Binney's and Aughey's errors have been noted in the previous paper.³ In 1868 Tryon repeated Binney's error,⁴ stating that *H. occulta* is found "fossil and bleached in the post-Tertiary of the western states, Indiana, Ohio, Mississippi, etc." All the authentic records of *Helicina* from Mississippi are those of *H. orbiculata*. Dr. A. Binney reported that species from the loess of Natchez in 1846.⁵ In 1854 Wailes reported "*Helix helicina*" from Mississippi, this evidently being intended for *H. orbiculata*. The writer found it very common in the loess of Natchez in 1898,⁶ but did not find *H. occulta*. It is safe to say that all specimens of fossil *Helicina* reported from south of Kentucky are *H. orbiculata*, fossils of that species being known only from the loess bluffs along the Mississippi River from Mississippi to Kentucky. Recent specimens of the species may be found from southern Florida to Texas, and northward to Tennessee, and Jasper County, Mo., the latter being the most northerly locality known.⁷

Other errors have resulted from this confusion of species. Thus, in 1875, Cox stated⁸ that *Helicina occulta* Say, "has not, I believe, been found living north of Arkansas." The statement applied, at the time, only to *H. orbiculata*. Dr. Snyder's report of *H. orbiculata*⁹

¹ D. D. Owen, *Geological Survey of Kentucky* (1856), p. 18.

² *Manual of Geology*, 4th ed. (1895), p. 966.

³ *Loc. cit.*, p. 176.

⁴ *American Journal of Conchology*, Vol. IV, p. 12.

⁵ *Proceedings of the Boston Society of Natural History*, Vol. II, p. 130.

⁶ See *American Geologist*, Vol. XXX, pp. 279-98.

⁷ See *Nautilus*, Vol. VIII (1894), p. 18.

⁸ *Geological Survey of Illinois*, Vol. VI (1875), p. 210.

⁹ In Leverett, *The Illinois Glacial Lobe*, Monograph No. XXXVIII, U. S. Geological Survey (1899), p. 171.

from Virginia, Ill., is also manifestly an error. The same probably applies to Dr. A. Binney's report of the same species from Ohio.¹

Neither recent nor fossil *H. orbiculata* extends northward to the border of the Kansan drift, both reaching almost the same latitude, that of the southwestern part of Kentucky. It is, therefore, decidedly a southern species, which has never been found in any condition in colder regions, and it is an abundant fossil in the southern loess. Indeed, the genus *Helicina* is almost wholly tropical, and before the habits and distribution of modern *H. occulta* were understood, the presence of a representative of this genus in the loess was looked upon as evidence that the climate was once *warmer* than at present. In this connection it may be of interest to read Dr. A. Binney's observations on this point, made more than half a century ago in connection with a discussion of the fossils of the Wabash River loess.² As the work in which it appears is not easily accessible, the material portion is quoted in full:

As the genus *Helicina* belongs mostly to inter-tropical regions, and has rarely been met with in a recent state in so high a latitude as that occupied by these fossils, a good deal of importance has been attached to its occurrence here as indicating such a change of climate as has been alluded to. But this supposition creates more difficulties than it obviates, for the numerous species of other genera found in company with the species in question, and which live at this time in the same district in which the fossils are situated, must, according to this view, have also been adapted to a warmer climate than the present, though they do not now exist in southern latitudes, and therefore a very considerable change in their habits must have *since* taken place. Notwithstanding the facility with which the terrestrial mollusks accommodate themselves to the physical influences which act upon them, such a change is not consistent with what we know of their history, and hence the most reasonable conclusion is that the climate in which they lived, from the days when the multitudes which now compose the mass of the fossil beds were in the enjoyment of life upon the surface of the earth, to the present time, has remained essentially the same.

Dr. Binney did not in his day, of course, take into account the intervals between the several loesses, during which it is more than probable that the climate was severe. With this modification his statement concerning the climate is still further borne out by the species under discussion, for it is now known that the habits of *H. occulta* are essen-

¹ *Terrestrial Air-breathing Mollusca of the United States* (1851), Vol. II, p. 353.

² *Ibid.*, Gould's ed., Vol. I (1851), pp. 182, 183.

tially the same as those of a number of terrestrial species now inhabiting the same area, and also often associated with this species in the loess. The present writer, long before he had access to Dr. Binney's work, repeatedly called attention¹ to the fact that the climate during the deposition of loess, as indicated by the fossils, was similar to that which prevails in the same region at the present time, and *H. occulta*, in common with a number of other species of terrestrial mollusks, offers strong testimony to this effect. The species does not extend far to the north, either in recent or fossil form, nor was it pushed far south by the ice-sheets following the Kansan. We have direct evidence of its existence only since the Kansan, but even if it occurred previous to the advance of Kansan ice, as it probably did, it still had plenty of room southward in which to persist. From this territory it again spread northward, but was checked by each of the ice-sheets following the Kansan. How far north the species extended during the several intervals preceding the final advance of the Wisconsin ice cannot be determined, as each advancing ice-sheet destroyed all the evidence of their presence, if any existed. That its advance² to the more northerly localities in which it lives today was comparatively recent, however, is supported by the fact that it has nowhere been found fossil in these northern localities. Thus, while recent specimens are not uncommon in Winneshiek and Howard Counties, Iowa, the loess of these counties has as yet yielded no fossils of this species.

Helicina occulta is not arctic, nor is it associated in the loess with species which are distinctively arctic. The fact that its range was not greatly extended during the oscillations of the successive glacial advances, and that it remained practically unchanged through all the interglacial loess-forming intervals, indicates a greater lack of

¹ First in the *Proceedings of the Iowa Academy of Sciences* for 1895, Vol. III, p. 85, and subsequently in several papers.

² The question might here be raised as to the manner in which such advance could be made. While the writer does not contemplate here the discussion of this subject, he desires to suggest that, among possible agencies, violent storms may be included. The *American Journal of Conchology*, Vol. V (1870), p. 118, contains the statement that "John Ford exhibited specimens of *Gemma gemma* Totten, remarkable for having fallen during a storm which occurred at Chester, Pa., on the afternoon of June 6, 1869." *Gemma gemma* is a small marine bivalve.

plasticity and adaptability than that which is displayed by almost any other terrestrial species. It therefore, supports, better than any other single species, the conclusion that in time past the conditions under which this and other loess species existed were essentially like those under which this species lives today—especially those which pertain to climate and vegetation—and that, therefore, during the deposition of the fossiliferous loess the climate was not glacial.